

# Mild-to-moderate sleep apnea is associated with incident hypertension: age effect

Alexandros N Vgontzas, Yun Li, Fan He, Julio Fernandez-Mendoza, Jordan Gaines, Duanping Liao, Maria Basta, Edward O Bixler

*Sleep*, Volume 42, Issue 4, April 2019, zsy265, <https://doi.org/10.1093/sleep/zsy265>

Published: 22 December 2018    **Article history** ▼

Views ▼   Cite   Permissions   Share ▼

## Abstract

### Study Objectives

Mild-to-moderate obstructive sleep apnea (OSA) is highly prevalent in the general population; however, previous studies on its association with incident hypertension are mixed. We examined the association between mild and moderate OSA and incident hypertension in a large random general population sample.

### Methods

From 1741 adults of the Penn State Cohort, 744 adults without hypertension or severe OSA (i.e. apnea/hypopnea index [AHI]  $\geq 30$  events/hour) were followed-up after 9.2 years. Mild OSA was defined as an AHI of 5 to 14.9 events/hour ( $n = 71$ ), while moderate OSA as an AHI of 15 to 29.9 events/hour ( $n = 32$ ). Incident hypertension was defined by a self-report of receiving antihypertensive medication and/or history of a diagnosis since their baseline study.

### Results

After adjusting for multiple potential confounders, mild-to-moderate OSA was significantly associated with increased risk of incident hypertension (overall hazard ratio [HR] = 2.94, 95% confidence interval (CI) = 1.96–4.41; HR = 3.24, 95% CI = 2.08–5.03 for mild OSA and HR = 2.23, 95% CI = 1.10–4.50 for moderate OSA). Importantly, this association was modified by age ( $p$ -interaction  $< 0.05$ ); while strong in young and middle-aged adults (HR = 3.62, 95% CI = 2.34–5.60), the association was lost in adults older than 60 years (HR = 1.36 95% CI = 0.50–3.72). Furthermore, the association of mild-to-moderate OSA with components of metabolic syndrome was strongest in young and middle-aged adults.

### Conclusions

Mild-to-moderate OSA, even when asymptomatic, is associated with increased risk of incident hypertension, but the strength of association significantly decreases with age. Although older participants with asymptomatic mild-to-moderate OSA are not at significant risk of developing hypertension, early detection and intervention, including improving metabolic indices, is especially warranted in young and middle-aged adults.

[sleep apnea](#), [sleep-disordered breathing](#), [hypertension](#), [cohort study](#), [incidence](#)

Topic:

[hypertension](#)

[obstructive sleep apnea](#)

[middle-aged adult](#)

[sleep apnea syndromes](#)

[apnea-hypopnea index procedure](#)

**Issue Section:** [Sleep Disordered Breathing](#)

You do not currently have access to this article.

## Sign in

Don't already have an Oxford Academic account? [Register](#)

## Oxford Academic account

Email address / Username [?](#)

Password

[Sign In](#)

[Forgot password?](#)

[Don't have an account?](#)

## Sleep Research Society members



[Sign in via society site](#)

## American Academy of Sleep Medicine members



[Sign in via society site](#)

---

## Sign in via your Institution

[Sign in](#)

## Purchase

---

[Subscription prices and ordering](#)

## Short-term Access

To purchase short term access, please sign in to your Oxford Academic account above.

Don't already have an Oxford Academic account? [Register](#)

Mild-to-moderate sleep apnea is associated with incident hypertension: age effect - 24 Hours access

EUR €36.00

GBP £28.00

USD \$45.00

## Rental



This article is also available for rental through DeepDyve.

[View Metrics](#)

### Email alerts

[New issue alert](#)

[Advance article alerts](#)

[Article activity alert](#)

[Subject alert](#)

---

[Receive exclusive offers and updates from Oxford Academic](#)

## Related articles in

[Google Scholar](#)

## Related articles in PubMed

Non-invasive ventilation for obese patients with chronic respiratory failure: Are two pressures always better than one?

Stature estimation from hand anthropometric measurements in Bangladeshi population.

Effects of prenatal cigarette smoke exposure on BDNF, PACAP, microglia and gliosis expression in the young male mouse brainstem.

Optimization and validation of the EconomicClusters model for facilitating global health disparities research: Examples from Cameroon and Ghana.

## Citing articles via

[Google Scholar](#)

[CrossRef](#)

**Latest** | **Most Read** | **Most Cited**

Characterization of the sleep disorder of anti-IgLON5 disease

Actigraphic detection of periodic limb movements: development and validation of a potential device-independent algorithm. A proof of concept study

Simultaneous tonic and phasic REM sleep without atonia best predicts early phenoconversion to neurodegenerative disease in idiopathic REM sleep behavior disorder

Residual symptoms after natural remission of insomnia: associations with relapse over 4 years

Sleep duration and fragmentation in relation to leukocyte DNA methylation in adolescents

**Looking for your next opportunity?**

CHIEF OF THE DIVISION OF ALLERGY,  
IMMUNOLOGY AND INFECTIOUS  
DISEASE  
New Brunswick, New Jersey

CHIEF OF THE DIVISION OF ALLERGY,  
IMMUNOLOGY AND INFECTIOUS  
DISEASE  
New Brunswick, New Jersey

Medical staff member - Clinical coordinator  
Department of orthodontics  
, Other / Non US

HIP PRESERVATION FELLOWSHIP

[View all jobs](#)

OXFORD  
UNIVERSITY PRESS

[About SLEEP](#)

[Editorial Board](#)

[Author Guidelines](#)

[Facebook](#)

[Twitter](#)

[Contact Us](#)

[Purchase](#)

[Recommend to your Library](#)

[Advertising and Corporate Services](#)

[Journals Career Network](#)

Online ISSN 1550-9109

Print ISSN 0161-8105

Copyright © 2019 Sleep Research Society

[About Us](#)

[Contact Us](#)

[Careers](#)

[Help](#)

[Access & Purchase](#)

[Rights & Permissions](#)

[Open Access](#)

## Connect

[Join Our Mailing List](#)

[OUPblog](#)

[Twitter](#)

[Facebook](#)

[YouTube](#)

[Tumblr](#)

## Resources

[Authors](#)

[Librarians](#)

[Societies](#)

[Sponsors & Advertisers](#)

[Press & Media](#)

[Agents](#)

## Explore

[Shop OUP Academic](#)

[Oxford Dictionaries](#)

[Oxford Index](#)

[Epigeum](#)

[OUP Worldwide](#)

[University of Oxford](#)

*further the University's objective of excellence in research, scholarship,  
and education by publishing worldwide*

Copyright © 2019 Oxford University Press  
Accessibility

Get Adobe Reader

Cookie Policy

Privacy Policy

Legal Notice

Site Map